FORGING BLANK FOR A GOLF CLUB HEAD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a forging blank for a golf club head. In particular, the present invention relates to a golf club head blank that is made by casting for subsequent forging.

2. Description of Related Art

Fig. 1 of the drawings illustrates a conventional forging process for manufacturing a golf club head. A metal bar 90 made of carbon steel or alloy steel is prepared after rolling and drawing. The metal bar 90 is then subjected to several forging procedures while passing through several forging molds 91a-91d. The cavities 92a-92d respectively of the forging molds 91a-91d vary in shape in sequence to thereby gradually forge the metal bar 90 to a shape corresponding to the respective cavity 92a-92d, thereby forming semi-products 90a-90d of a golf club head. Finally, the semi-product 90d is subjected to several surface finishing procedures to obtain a final product of a golf club head.

In spite of the advantages of uniform steel distribution and high strength of the golf club head made by forging, the manufacturing cost is high, as there are many forging molds 91a-91d required. Further, frequent replacement of the forging molds 91a-91d is required, as they are apt to deform under the forging pressure. Further, the specifications of the golf club

head products are not uniform. Further, significant deformation occurs while forging the metal bar 90 to the semi-product 90d. As a result, if the extensibility of the steel of the metal bar 90 is insufficient to withstand the deformation, cracks 93 are apt to be generated in a portion of the metal bar 90 that is to be bent. The forging result becomes poor, and the qualified product rate is lowered. The extensibility and the forging quality of the metal bar 90 can be improved by means of high-temperature solid solution heat treatment, yet the overall process is prolonged. Further, the high temperature heat treatment causes deformation of the forging molds 91a-91d, which shortens the lives of the forging molds 91a-91d and adversely affects the forging precision.

Figs. 2A through 2E illustrate another conventional process for manufacturing a golf club head by casting. A casting mold 81 having a cavity 811 is prepared, wherein the cavity 811 is configured corresponding to the specification of a predetermined golf club head. Molten wax is poured into the cavity 811 of the casting mold 81 for forming a wax mold 80 (Fig. 2A). The wax mold 80 is then removed from the cavity 811 and immersed in a solution to form a ceramic outer mold 82 (Fig. 2B). Next, the wax mold 80 is melted and flows out of the ceramic outer mold 82 (Fig. 2C). Then, molten metal liquid is filled into the ceramic outer mold 82 (Fig. 2D) to form a golf club head blank 83 (Fig. 2E). The golf club head blank 83 is then subjected to several surface finishing procedures to obtain a final product of a golf club

head.

The golf club head manufactured by casting is suitable for mass production and has a low manufacturing cost. Further, the golf club head manufactured by casting has improved properties in the stretching-resistance, wear-resistance, and metal fatigue, which are almost equivalent to those of a golf club head manufactured by forging. However, undesired cinder holes 84 (or sand holes, air holes) are apt to be formed in the surface of the golf club head blank 83 during the casing process, as shown in Fig. 3. The cinder holes 84 remain in the surface of the final product of the golf club head if the surface polishing of the golf club head blank 83 is insufficient. On the other hand, the dimension of the final product of the golf club head is adversely affected if excessive surface polishing of the golf club head blank 83 is carried out. Further, formation of the golf club head blank 83 would not be appropriate if the ceramic outer mold 82 is not completely filled with the molten metal as a result of poor flowability of the molten metal.

Cinder holes 84 cause more serious problems to a golf club head made of a Fe-Mn-Al alloy having a high viscosity and thus having a poor casting property, resulting in disqualified products. Further, in a case that an AISI 8620 steel or an AISI 4130 steel is used for manufacturing a golf club head, the golf club head provides a good shock-absorbing effect and a good feeling while striking the golf ball, as the AISI 8620 steel and an AISI 4130 steel have a low hardness about HRB 80-100. However, in the above-mentioned casting

process, the molten alloy having poor flowability could not be reliably filled in the ceramic outer mold 92, failing to obtain a golf club head blank 83 with a good shape.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a forging blank for a golf club head for speeding up the manufacturing process, reducing the manufacturing cost, and allowing mass production.

Another object of the present invention is to provide a forging blank for a golf club head for increasing the qualified product rate.

A further object of the present invention is to provide a forging blank for a golf club head that allows the golf club head to be made from various materials.

Still another object of the present invention is to provide a forging blank that allows manufacture of a golf club head by using less forging molds.

SUMMARY OF THE INVENTION

In accordance with an aspect of the present invention, a forging blank for a golf club head is made by casting and comprises at least one bending portion having a first end and a second end, a club head portion extending from the first end of said at least one bending portion, and a hosel portion extending from the second end of said at least one bending portion.

Preferably, each of the club head portion and the hosel portion has a substantially circular section.

In an embodiment of the invention, the club head portion of the forging blank has a sectional area greater than that of the hosel portion. The club head portion of the forging blank is forged to form a body of a golf club head, with the body having a striking face.

In another embodiment of the invention, the club head portion of the forging blank has a sectional area smaller than that of the hosel portion. The club head portion of the forging blank is forged to form a striking portion of a golf club head. A weight member is bonded to a rear side of the striking portion to form a body of the golf club head.

The forging blank may be made of a Fe-Mn-Al alloy, an AISI 4130 steel, or an AISI 8620 steel.

Other objects, advantages and novel features of this invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram illustrating a conventional forging process for manufacturing a golf club head;

Figs. 2A through 2E are schematic diagrams illustrating another conventional process for manufacturing a golf club head;

Fig. 3 is an enlarged view illustrating cinder holes in a golf club head manufactured by the conventional process of Figs. 2A through 2E;

Fig. 4 is a side view of a forging blank for a golf club head in

accordance with the present invention;

Fig. 5 is an exploded view illustrating forging of the forging blank in accordance with the present invention;

Fig. 6 is a sectional view illustrating generation of burrs on the golf club head semi-product after the forging step.

Fig. 7 is a side view of the golf club head semi-product after removal of the burrs;

Fig. 8 is a perspective view of a final product of the golf club head made from the forging blank in accordance with the present invention;

Fig. 9 is a side view of a modified embodiment of the forging blank in accordance with the present invention; and

Fig. 10 is an exploded perspective view of a final product of a golf club head made from the forging blank in Fig. 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of the present invention is now to be described hereinafter in detail.

Referring to Fig. 4, a forging blank for a golf club head in accordance with the present invention is designated by 10 and made by casting to a volume having a processing tolerance (i.e., a preserved volume for processing) allowing subsequent processing to form a final product of a golf club head 10a. The forging blank 10 can be obtained by, e.g., the casting process of Figs. 2A through 2E or other processes. The casting material for the forging blank

10 is selected from metals or alloys, such as a Fe-Mn-Al alloy, an AISI 8620 steel, or an AISI 4130 steel. After casting, the forging blank 10 includes at least one bending portion 11 (one in this embodiment) having a first end and a second end, with a club head portion 12 extending from the first end of the bending portion 11 and with a hosel portion 13 extending from the second end of the bending portion 11. The club head portion 12 has an angle α preferably between 100 and 150 . Dimensions (such as thickness D, d, sectional area, etc.) of the club head portion 12 and the hosel portion 13 are selected according to the product needs. The ratio of sectional area to the perimeter of the club head portion 12 is not equal to that of the hosel portion 13. Preferably, the club head portion 12 and the hosel portion 13 have a substantially circular section. In this embodiment, the club head portion 12 has a sectional area greater than that of the hosel portion 13. Further, few cinder holes 101 are formed on the forging blank 10 after casting.

As mentioned above, the volume of the forging blank 10 has a processing tolerance (i.e., a preserved volume for processing) allowing subsequent processing to form a final product of a golf club head 10a. The overall volume of the forging 10 is equal to a sum of a reduced volume in a forging step, a volume of burrs to be removed, a removed volume during surface finishing, and a volume of the final product of the golf club head 10a. Namely, the preserved volume for processing of the forging blank 10 is equal to a sum of the reduced volume in a forging step, the volume of burrs to be

removed, and the removed volume during surface finishing.

Referring to Fig. 5, the forging blank 10 is forged by at least one forging mold 20. The number of the forging mold(s) can be selected according to the need of the processing procedure. The forging mold 20 has a cavity 21 corresponding to the size of the final product of the golf club head 10a. When the golf club head casting 10 is placed in the cavity 21 and forged, the angle α at the bending portion 11 of the forging blank 10, the thicknesses of the club head portion 12 and the hosel portion 13, and the sectional areas of the club head 12 and the host 13 are adjusted. Since the forging blank 10 has an angled bending portion 11, only a slight angle adjustment of the forging blank 10 by the forging mold 20 is required, and the slight angle adjustment causes slight deformation. This avoids the risk of generation of cracks in the bending portion 11 resulting from over-bending, keeping the structure of the forging blank 10 intact.

As illustrated in Fig. 6, burrs 102 (see the gap adjacent to the cavity 21 of the forging mold 20) are generated on the club head semi-product 10' after the forging step. After the golf club head semi-product 10' is removed from the forging mold 20 and cooled and takes shape, the burrs 102 are removed (Fig. 7), and a final product of a golf club head 10a (Fig. 8) is obtained after surface finishing. The resultant golf club head 10a includes a neck 11a formed by the bending portion 11, a body 12a formed by the club head portion 12, and a hosel 13a formed by the hosel portion 13, with the body 12a having

a striking face for striking a golf ball. It is noted that the golf club heads made from the forging blanks in accordance with the present invention have an aesthetically pleasing appearance and a uniform specification.

Preferably, the reduced volume in the actual forging step is preferably controlled to be equal to the predetermined reduced volume in the forging step. Thus, the forging blank 10 can be forged to a golf club head semi-product 10' that has a specification approximate to that of the final product of the golf club head 10a. At the same time, the cinder holes 101 in the surface of the forging blank 10 are removed in the forging step, avoiding the risk of disqualified products resulting from the cinder holes 101 while reducing the time for subsequent surface finishing.

Further, after forging, a surface layer of less than 0.5 mm of the golf club head semi-product 10' possesses a stream-lined microstructure, thereby improving the mechanical properties of the surface of the golf club head semi-product 10'. At the same time, the structure of the portion under the surface layer of the golf club head semi-product 10' possesses excellent toughness resulting from casting. The strength of the final product of the golf club head 10a is thus improved. Further, since the cinder holes 101 in the surface of the forging blank 10 can be effectively removed by the combined casting/forging process, a casting obtained from a Fe-Mn-Al alloy that tends to have cinder holes as a result of poor casting property can be used without adversely affecting the good product rate of the final products of the golf club

heads 10a. Namely, various materials can be used as the forging blanks to manufacture golf club heads.

Further, since the forging blank 10 has a bending portion 11 with an angle α, a high-temperature solid solution heat treatment for improving extensibility of the forging blank 10 can be omitted in the forging process. Even if a high-temperature solid solution heat treatment is carried out for improving extensibility of the forging blank 10, the temperature of the heat treatment can be at a relatively lower range (about 750-1050 ℃). Thus, the overall time for manufacturing a golf club head is shortened, and the life of the forging mold is prolonged. Further, the above-mentioned ratio of the sectional area to the perimeter of every portion of the forging blank 10 is increased, which reduces the heat loss during the heat treatment and benefits the extensibility of the forging blank 10 at high temperature.

Figs. 9 and 10 illustrate a modified embodiment of the forging blank. In this embodiment, the club head portion 12' of the forging blank 100 has a thickness D' and a sectional area respectively smaller that a thickness d' and a sectional area of the hosel portion 13'. After at least one forging step, the thickness D' of the club head portion 12' is sufficient to form a striking portion 121 of a final product of a golf club head 10a, the bending portion 11' of the forging blank 100 forms a neck 11a of the golf club head 10a, and the hosel portion 13' forms a hosel 13a of the golf club head 10a. Further, a weight member 122 can be bonded to a rear side of the striking portion 121 to

form a body 12a of the golf club head 10a.

When the forging blank 100 has a thinner club head portion 12', since the ratio of the sectional area to the perimeter of the forging blank 100 is increased, Fe-Mn-Al alloys having poor casting properties as well as AISI 8620 steel and AISI 4130 steel having a poor flowability in molten state can be used as the forging blanks for manufacturing golf club heads. Generation of the cinder holes is reduced, and the casting effect is improved.

The forging blank in the above embodiments includes only one bending portion 11, 11'. It is noted that the forging blank may include two or more bending portions according to the product need.

According to the above description, the forging blank 10, 100 with at least one bending portion 11, 11' in accordance with the present invention reduces the times for forging and reduces the amount of deformation. The surface properties and the strength of the final product of the golf club head 10a are improved. The cinder holes 101 are reduced, the process is speeded up, the manufacturing cost is cut, the forging effect is improved, and various materials can be used as the forging blank for manufacturing a golf club head.

While the principles of this invention have been disclosed in connection with its specific embodiment, it should be understood by those skilled in the art that these descriptions are not intended to limit the scope of the invention, and that any modification and variation without departing the spirit of the invention is intended to be covered by the scope of this invention

defined only by the appended claims.